Energy management and energy conscious design of **buildings**, production and processes in Denmark

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Energy management - background and history

- As of January 1st, 1997 all buildings in Denmark must be energy labelled.

  According to a legal Act and Executive orders all large buildings (>1500 m²) must be energy labelled once a year and all small buildings, when sold.
- The energy labelling includes both an energy rating and an energy plan.

Buildings included

The buildings covered by the scheme are:

- residential buildings,
- buildings used for trade,
- buildings used for private services and
- public buildings.

Buildings exempted

- Buildings used for industrial production, storage houses, churches and buildings with no or very limited energy consumption
- Furthermore, buildings are exempted from the scheme for 2 years, if they receive an A-mark (on the scale A to M) for heating and electricity consumption, **or** if the energy plan includes (profitable) saving suggestions with a total reduction of less than 5% CO2 emission.

The major aim

is to raise awareness of energy consumption and savings in:

- **daily building administration**
- **planning of improvements and**
- **building maintenance.**

The practical basis

- The ELO-scheme (for large buildings) is based on continuous registration of the actual consumption and comparison with similar buildings.

- The energy management scheme consists of two parts:
  - **an energy label and**
  - **an energy plan**

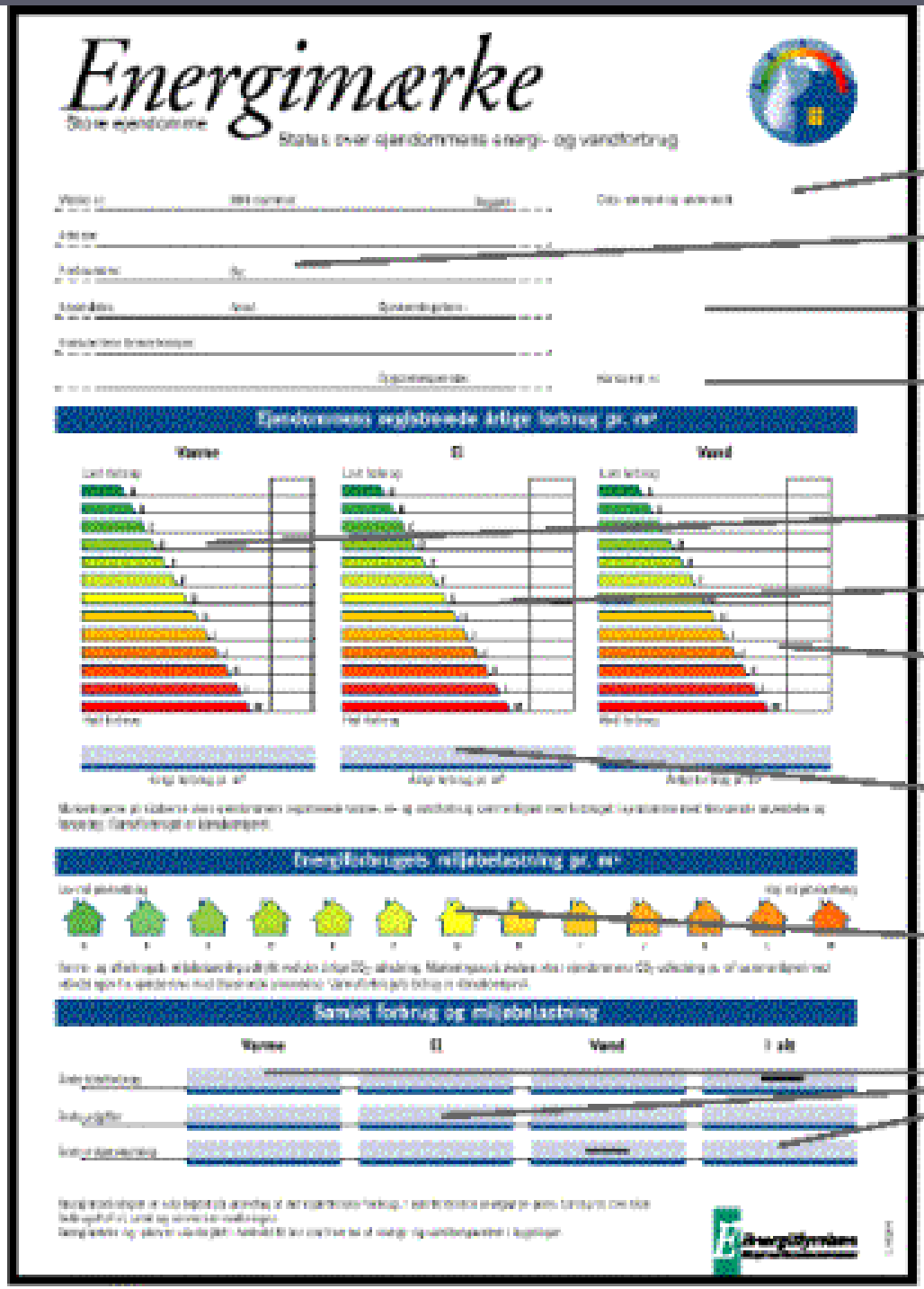
The energy label

The energy labelling of a building consists of a standardised rating containing the measured:

- electricity and
- heat consumption (pr. heated m²) and
- water consumption (pr. total m²) and
- CO2 emission (pr. heated m²) compared year by year and with similar buildings

The 4 ratings are shown on a scale from A to M.

The measured heat consumption is climate corrected (degree days)



Date

Identification of building

Identification of consultant

Signature

Labelling of Heating

Labelling of Electricity

Labelling of Water

Consumption pr. m^2

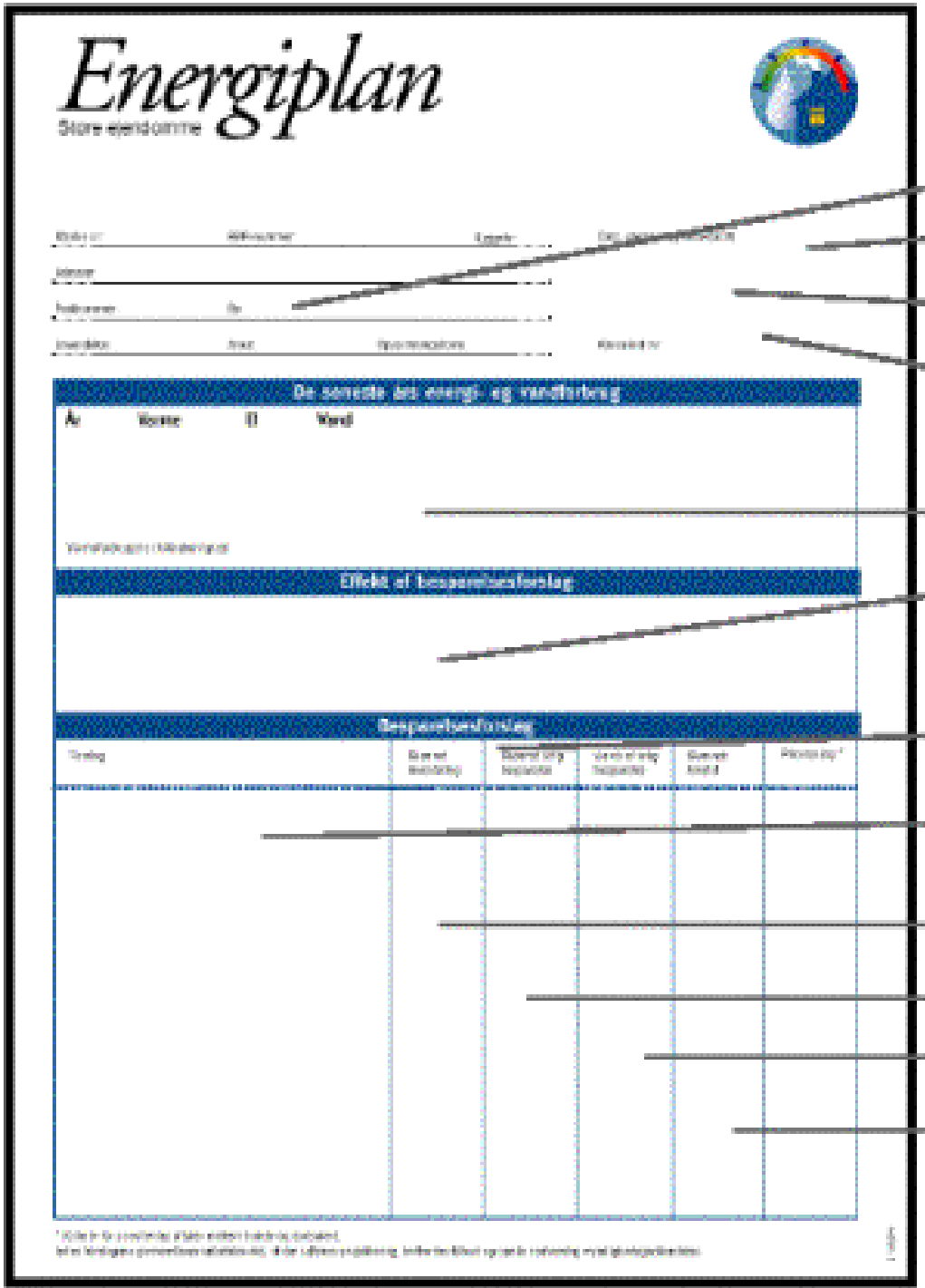
Environmental Impact

Consumption

The energy plan

The energy plan show:

- the history of energy and water consumption over the last 3 years
- assessment of possible saving initiatives
- improvements in combination with general maintenance
- special proposals for investments in insulation, the heating system, electric or water using appliances


Energiplan
Store ejendomme
Identification of Building
Date
Identification of consultant
Signature
Last 3 Years Consumption
Possible Savings
Energy Plan
Recommendation for Improvements
Investment, price in DKK
Annual heat savings
Annual savings in DKK
Estimated lifetime in years

Database

All registrations of buildings are integrated in the ELO database, which is updated on a daily basis

internet address:
(www.energiledelsesordningen.dk)

ELO-consultants and ELO-PC

- Consultants have obtained an ELO license
- With the license they receive the ELO-PC programme, which is an obligatory tool used by all ELO-consultants to:
  - enter data,
  - calculate,
  - give rating and
  - print out all energy labels.

The role of the building owner

- It is the responsibility of the owner to engage with an ELO-consultant for the yearly registration of the building.
- Further, the owner is to point out an internal Energy Manager/Care Taker, who shall follow-up on the energy label and plan:
  - with a monthly registration of the consumption and
  - approved work journals and
  - liaise with the ELO-consultant.
- The idea is that the monthly registration should initiate an internal energy management process.

The role of the ELO-consulant

- The role of the ELO consultant is to act as a generalist, who considers the condition of the building in total.
- The consultant is in periodical contact with the appointed Energy Manager/Care Taker of the building and the technical staff.
- The parts of the building and the installation, which are in focus, may vary from year to year. Special request from the owner of the building can be included in the energy plan
- For more specialized and focused inspections or assessments, the owner has to engage with a technical specialist.

Quality Assurance

The quality assurance consists of the following procedures/initiatives:

- random control of reports by inspections covering around 5 to 10% of all reports
- quality assurance as result of enquiries made by building owners
- external evaluations

Problems

Experience shows that the built-in automatic of the **ELO-PC programme** also has the disadvantage that some ELO-consultants tend to focus too much on the programme and its output.

Some of the examples are:

- uncritical use of ELO-PC standard solutions
- lack of comments on conspicuously high consumption levels,
- lack of engagement and use of own observations.

Results of an evaluation

Some of the conclusions:

- The ELO scheme has implied that quite many buildings which have not used energy advising before have been introduced to energy management, etc.
- The ELO consultants received positive feedback for their work from their clients
- In general, the clients find the ELO service relevant
- **It was found that there is a considerable unexploited potential for energy savings in buildings participating in the scheme and in particular in buildings which - despite the legal requirement - do not take part**

Lessons learned

- The ELO Scheme has proved to be a suitable tool for raising awareness on energy and water consumption and reduction possibilities among owners of large buildings.
- In most cases, owners have experienced that the yearly compulsory ELO inspection has delivered "added value" by pointing out methods and possibilities of saving energy and water (money!).
- Danish experience shows that one should be careful to safeguard the positive perception towards the ELO scheme among building owners and hence not enforce legal requirements in cases where it is evident that there will be no added value in terms of savings!

The EU directive

Energy Performance of Buildings Directive –

EPBD

Danish Standard for Energy management (DS 2403)

- Energy Management - Guidance on energy management of buildings, production and processes.

- DS 2304 is an extension of the energy part in ISO 14000

The fundamentals of DS 2403

- The system includes a method for
  - ”energy efficient design”,
  - monitoring and control of energy consumption,
  - energy conscious maintenance,
  - information, and education of employees.

- and includes also a set of tools

- Energy management is an essential part of ”the voluntary agreements scheme” on energy efficiency:
  - Energy-intensive industrial companies can receive a rebate on the green taxes by entering an agreement with the Danish Energy Authority.

The method of energy conscious design

5 generel recommendations:

- Consider energy conservations as early as possible
- Be critical to already defined needs and carry out a new analysis of needs
- Always make a total-economical analysis covering invenstments and the economical value of savings
- Use the experience of others - use guidelines and design tools
- Involve the companies marketing energy saving equipment as co-players - put forward requirements when offers are asked for and contracts written

Tools

- general and specific guidelines
- catalogue of systems
- excel-programs for
  - ventilation
  - heat producing systems
  - pressure drop
  - cooling and frost-room systems
  - drying
  - under-pressure systems (vacuum)

examples

- on the website case studies from a number of different industries are found

- to serve as inspiration and to learn from

The catalogue – a standard technology description

The technology description always contain the following 3 headings:

- no extra costs
- small extra costs
- larger extra costs

The education program

- Goal-setting – policy making
- Analyses and technologies
- Planning
- Buying
- Use of benchmarks / key numbers
- Information of the workers
- Monitoring
- Maintenance
- Examples

Why do we still have too little action?

Because of barriers! - What kind of barriers ?

- economical and managerial
- organisation and focus
- knowledge/information
- user behaviour

source: the Danish assoc. of municipalities

economical and managerial barriers

- the political process is not always economically based
- the additional costs are only considered as costs - not investments
- no economical (or no cleare economical) motivation

organisation and focus barriers

- responsibility without competence (economical, technical (energywise)
- missing link from (e.g.) school to town hall

- missing managerial and political focus

knowledge/information barriers

- municipalities/institutions lack knowledge about energy saving measures
- the theoretical savings are considered unreliable!!!

user behaviour barriers

- when the physical framework is worn out it can be difficult to motivate people to care and change behaviour

- there is an expectation/prejudice that it is not possible to make people/workers/ pupils to change behaviour

How do we realise the potentials?

- Legislation ?
- Information ?
- Visualisation ?

Thank you

for your attention!

evaluation cont.

- There are also large variations in the degree of coverage for the different categories of buildings. Residence buildings, schools, hospitals and institutions have the highest representation, while trade and service companies and hotels do not have a high degree of coverage

- It is evident that a larger part of the buildings registered in the Scheme has implemented saving initiatives compared to buildings not taking part

evaluation cont.

- The data registration is not perfect, and part of the data is uncertain.
- In particular, the registration and follow-up of the saving potentials and proposed saving initiatives do not allow a consistent assessment of whether, when and to what extent suggested saving-proposals have been implemented.

evaluation cont.

- Even though the scheme is compulsory, only around 42% of potential buildings and 52% of the total area in m² are registered in the Scheme. There is a considerable geographical variation, with 55% of the large buildings in Greater Copenhagen being registered and, in the other end of the scale, only 31% in Storstroems County
- One of the main reasons for the non-coverage in certain areas is that building owners have not been acquainted with the Scheme. It is notable that around 50% of the interviewed owners, who were not registered, did not have any knowledge of the scheme